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Translation of Parts of Japanese Unexamined Laid-open Patent Publication No.02-175142

- 5 (1) Page 259, left column, line 1 to page 260,  
right upper column, line 14

Specification

1. Title of the Invention

10 Chassis, body or part and a method of producing  
the same

2. Claims

15 1. Chassis, body or part which is covered  
with a film containing an organic substance, and  
which is conductive or has a conductive surface,  
characterized in that a film containing fluorine  
or like halogen element is formed on the film  
containing an organic substance, the film having  
a light-transmitting property, and having carbon  
or containing carbon as a main component.

20 2. The chassis, body or part according to  
claim 1, wherein the film having carbon or  
containing carbon as a main component is water-  
repellent.

25 3. Chassis, body or party which is  
conductive or has a conductive surface, and has a

coating surface formed of a film containing an organic substance, wherein the coating surface containing an organic substance is coated with a film containing carbon or having carbon as a main component which has a volume resistivity of  $1 \times 10^7$  to  $5 \times 10^{13} \Omega \cdot \text{cm}$ .

4. The chassis, body or party according to claim 3 which is a thing for composing a motor vehicle, motor bicycle, bicycle, ship, air craft or the like and wherein the coating surface may be exposed to winds and rain.

5. The chassis, body or party according to claim 3, wherein the coating surface has an insulation property and has a volume resistivity of  $1 \times 10^{15} \Omega \cdot \text{cm}$  or more, and the carbon film formed on the coating surface has a light-transmitting property.

6. A method of producing chassis, body or party which is conducive or has a conducive surface, the method comprising the steps of:  
holding the chassis, body or party;  
applying a bias of DC and AC to the chassis, body or part under reduced pressure;  
introducing a carbonated substance gas into an atmosphere under reduced

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pressure, surrounding the chassis, body or part to form a plasma therefrom, and thereby covering the chassis, body or part with a film having carbon or containing carbon as a main component.

- 5           7. The method according to claim 6, wherein an electric field formed by the bias is applied more concentratedly on a convex portion of the chassis, body or part having an uneven surface than on a concave portion thereof;
- 10          whereby the film containing carbon or having carbon as a main component formed on the convex portion is larger in thickness.

8. Chassis, body or part which is conductive or has a conductive surface, and which
- 15          is covered with a film containing an organic substance, characterized in that a coating film containing an inorganic substance is formed on the film containing an organic substance.

3. Detailed description of the invention
- 20          (Field of the invention)

- This invention relates to bumpers or like parts of automobiles, ships, air craft or like transport means, surfaces of which are coated with a coating film and may be exposed to winds
- 25          and rain or may be scrubbed with winds. The

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coating film is coated with a protection film having carbon or containing carbon as a main component or with a film containing an inorganic substance such as silicon nitride. The film-  
5 covered surface has an increased abrasion resistance, achieves protection against the adhesion of dust and prevents occurrence of static electricity.

The invention provides such thin film  
10 which shows light transmittance in a visible range, which contains carbon or have carbon as a main component and which is sufficient in hardness, or one which contains an inorganic substance such as silicon nitride as a protective  
15 film for preventing abrasion. Especially the protective film can be closely adhered to the organic substance and can be given a volume resistivity of  $1 \times 10^7$  to  $5 \times 10^{13} \Omega \cdot \text{cm}$  to prevent occurrence of static electricity, to  
20 provide a surface smoothness and to prevent adhesion of dust.

The invention aims to form a carbon film or a film containing carbon as a main component or a film containing an inorganic substance over such  
25 chassis, bodies or parts by a plasma CVD method.

(2) Page 260, left lower column, line 4 from the bottom to right lower column, line 4 from the bottom

5 (Means for overcoming the problems)

The invention provides a film having carbon or containing carbon as a main component for protection of a coating surface (film) containing an organic substance formed on chassis, 10 bodies, bumpers or like parts of automobiles, ships, air craft or the like, and being exposed to winds and rain and being scrubbed with winds, especially a film containing a halogen element such as fluorine and containing carbon as a main 15 component. The film can prevent occurrence of static electricity which is likely to occur when the film is scrubbed with winds along with dust, and it prevents loss of gloss which may be caused by adhesion of dust and abrasion of coating 20 surface by dust, thereby keeping the fresh state of coating surface exhibited immediately after application of coating composition all the time. Especially the film containing a halogen element and having carbon as a main component is water 25 repellent and therefore serves to prevent

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staining.

The present invention was accomplished based on the discovery that the intended protective film may be one in which a plasma polymerization film having an electrical specific resistance of  $1 \times 10^7$  to  $5 \times 10^{13} \Omega \cdot \text{cm}$ , namely a relatively low resistance, can be closely adhered to the organic substance. The low resistant film is formed on the surface of coating film so that a static electricity can be prevented from occurrence and the adhesion of dust and abrasion of coating surface by dust can be inhibited.

(3) Page 261, right upper column, line 15 to left lower column, line 14

An example of production of such thin film is as follows. There is introduced a carbon fluoride gas such as fluorocarbon, e.g.,  $\text{C}_2\text{F}_4$ ,  $\text{C}_3\text{F}_4$ ,  $\text{CF}_4$ ,  $\text{CH}_2\text{F}_3$ , etc. A mixed gas thereof with  $\text{H}_2$  is made into a plasma or a mixed gas thereof with  $\text{C}_2\text{H}_4$  and carbon hydride is made into a plasma to give activated hydrogen which can achieve defluorination and decomposition, or there is introduced a hydrocarbon gas such as ethylene ( $\text{C}_2\text{H}_4$ ), methane ( $\text{CH}_4$ ), acetylene ( $\text{C}_2\text{H}_2$ ), a mixed

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gas thereof with nitrogen fluoride, or a fluorocarbon gas such as carbon fluoride, e.g.  $C_2F_4$ ,  $C_2F_6$ ,  $CF_4$ ,  $CH_2F_2$ , or the like to achieve decomposition so that a C-C bond like diamond having an  $SP^3$  orbit is formed, thereby giving a film containing carbon or having carbon as a main component which shows light transmittance in a visible region and which has properties similar to those of diamond and which has a specific resistance of  $1 \times 10^7$  to  $5 \times 10^{13} \Omega \cdot cm$ , typically  $1 \times 10^3$  to  $5 \times 10^{11} \Omega \cdot cm$ , and has an optical energy band width (called  $E_g$ ) of 1.0 eV or more, preferably 1.5 to 5.5 eV, especially giving a film containing a halogen element such as fluorine, and having carbon or carbon as a main component (minor components including mainly hydrogen, fluorine and nitrogen).

(4) Page 261, left lower column, line 1 from the bottom to right lower column, line 6

The surface of coating composition film is formed according to the invention using a polyester resin, alkyd resin, oil-free alkyd resin, unsaturated polyester resin, acrylic resin, amino resin or the like. Especially in an



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automobile manufacture line, a coating composition film surface is formed from an organic solvent-type coating composition containing acryl laquer, acryl melamine, block  
5 acryl urethane or the like.

(5) Page 264, left upper column, line 6 to right upper column, line 10  
(Effect).

10 The invention provides a film capable of being well drained (being water repellent), containing carbon as a main component and a halogen element such as fluorine and having a Vickers hardness of 600 to 3000 Kg/cm<sup>2</sup> or a  
15 multi-layer carbon film formed on the closely deposited organic substance as an under layer, the film having a Vickers hardness of 1000 to 7000 Kg/cm<sup>2</sup> (containing hydrogen as well). The resulting film is formed thickly as an abrasion-  
20 resistant film on convex portions which may be exposed to winds and rain and scrubbed with dusty winds.

A thin film containing an inorganic substance such as silicon nitride can be  
25 effectively used as an abrasion-resistant film.

The freshness of coating surface of automobiles can be improved and can prevent the color from losing the gloss in a few years.

DLC(diamond-like carbon) is described as  
5 an example of the film to be formed in the present invention.

As apparent from the above, a film or a multi-layer film containing an organic resin was formed in the invention. A complex of films finds  
10 a variety of applications as in numerous other working examples described above. The film containing carbon can be formed at a low temperature of 150°C or lower. Therefore the film shows no change in color even due to denaturation  
15 of organic substance in the coating surface of the underlying layer. The film is excellent in hardness and in adhesion to the substrate.